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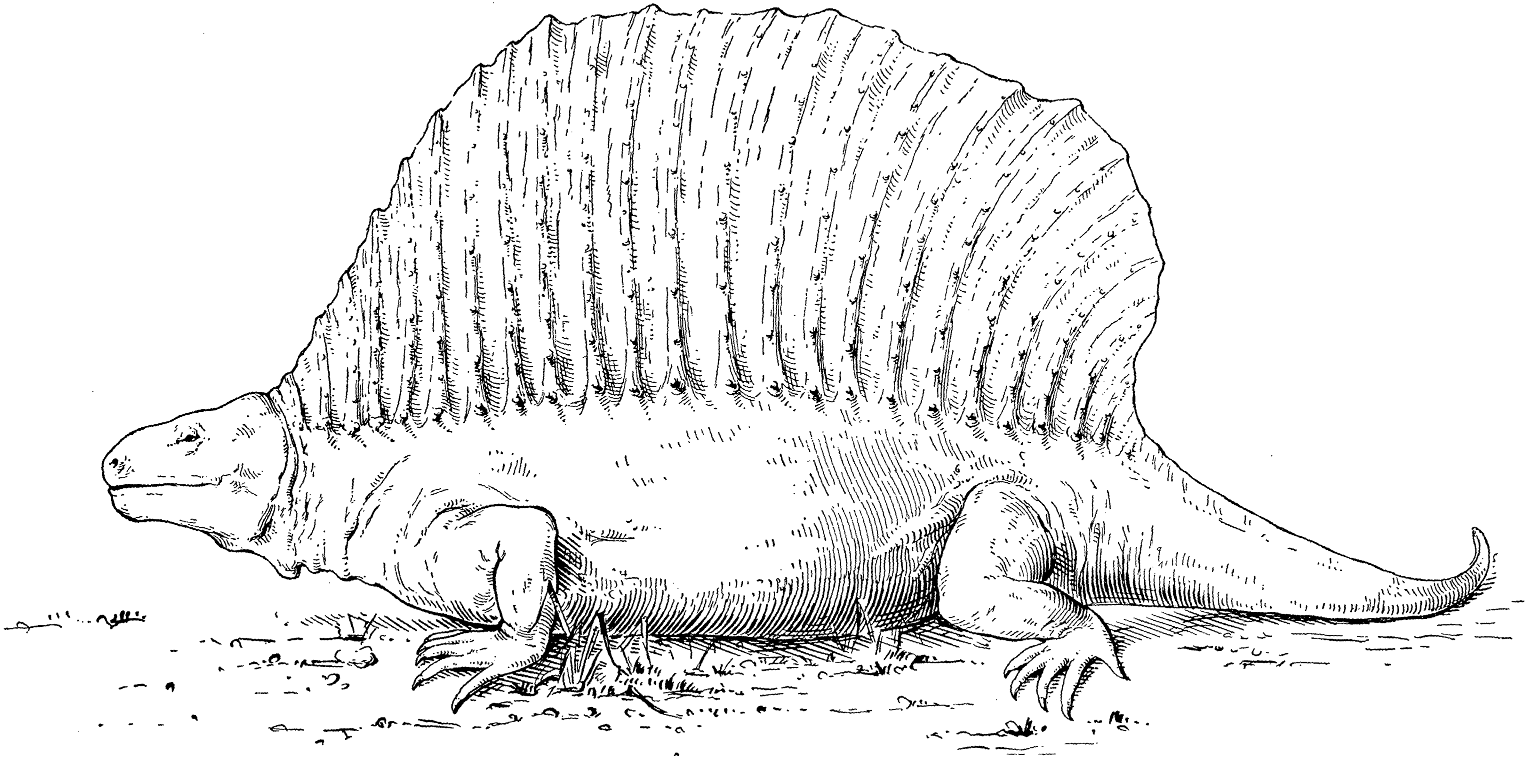

Restoration of *Edaphosaurus cruciger* Cope.

RESTORATION OF EDAPHOSAURUS CRUCIGER COPE

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IN the year 1882 Cope described from the Permian beds of Texas, an imperfect reptilian skull which he called *Edaphosaurus pogonias.* Two years later he described for the first time, the wonderful vertebræ with elongate spines bearing lateral projections on the sides. These vertebræ he assigned to the same genus as the skull but later they were removed to a separate genus as he considered that the two specimens represented different forms of reptilian life. The vertebræ with long spines and cross pieces were placed in the genus *Naosaurus*—"Ship-lizard," a name suggested by the fancied resemblance of the spines with their lateral projections to the masts and yard-arms of a full-rigged ship.

From the time of the original description until 1907 the two genera were regarded as distinct but in that year Case[1] suggested that the two genera should be united and that the skull described as *Edaphosaurus* by Cope belonged with the vertebral column and limb bones described under the name *Naosaurus.* The similar condition of elongate spines, but without cross pieces, on the vertebræ of the carnivorous genus *Dimetrodon* very naturally led to the belief that the two forms *Edaphosaurus* and *Dimetrodon* were similar in other parts of the body and *Naosaurus* merely exhibited something of the extravagance in spines, rugosities, tubercles, etc., which is such a common feature in the most highly specialized members of any group which is approaching the final stages of its family or generic life. The close relationship of the two genera was so probable that it was accepted by all paleontologists and even Case was very reticent in his suggestion that they were much farther apart than was usually thought. Following the generally conceived idea of *Naosaurus* a composite mount was prepared in the American Museum of Natural History in New York in which the skull and limb bones of a *Dimetrodon* were associated with the vertebral column of a *Naosaurus.* This restoration was published by Dr. Osborn in the Bulletin of the American Museum and a model of the creature in the flesh was prepared under his direction by Mr. Chas. Knight. Case in his "Revision of the Pelycosauria of North America" republished this restoration by Osborn but at the same time published an alternative restoration in which the skull described as *Edaphosaurus* was associated with the vertebral column of *Naosaurus* and the two genera were united under the former name, as it had priority.

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[1] Publication 55, Carnegie Institution of Washington.

The composite restoration prepared at the American Museum has gained wide circulation in the text books but later discoveries have shown that it was unfortunate. In the summer of 1911 Dr. F. v. Huene, of Tübingen, while a guest of the joint expedition from the universities of Chicago and Michigan to the Permo-Carboniferous beds of New Mexico, discovered the remains of a skeleton of *Edaphosaurus* in which both the skull and a portion of the vertebral column were preserved. As the vertebræ bore the typical cross-pieces of the genus *Naosaurus* the identity of the two genera was established but new evidence was speedily coming; Case in the summer of 1912 discovered in the Permo-Carboniferous beds of Archer County, Texas, the nearly perfect vertebral column of an *Edaphosaurus* (*Naosaurus*) *cruciger* Cope with the limb bones, and a crushed skull, identical with the skull originally described as *Edaphosaurus.*

From this skeleton, now preserved in the museum of the University of Michigan, the author has prepared the restoration shown in Fig. 1. The only conjectural parts are the size of the feet and the length of the tail; the remainder is based upon careful measurements from a single specimen. So far from being a carnivorous, raptorial animal similar to *Dimetrodon, Edaphosaurus* was harmless, molluscivorous or insectivorous with possibly some ability to masticate vegetable matter. The edges of the jaws were lined with sharp conical teeth and upon the palate and the dentary bones were strong plates supporting numerous blunt, conical teeth. The head in all specimens recovered seems rather small for the size of the body and in this is peculiar in the Permo-Carboniferous reptilian fauna, in which the reverse is the rule. The shape of the head in the restoration is taken from the nearly perfect and undistorted skull in the museum of the University of Chicago. The elevated dorsal spines begin with the third vertebræ and speedily reach a considerable height. The lateral projections are elongate at the base of the spine but above the middle are reduced to mere nodules irregularly arranged. The author is not in accord with the suggestion made by Jaekel and Abel that the spines were separate, and can see no reason for the suggestion made by the former that the spines were movable. The strongly interlocking zygapophyses render such an idea impossible to any one familiar with the skeleton. Nor does the author believe that the spines were of any use to the creature as offensive or defensive weapons; rather, as he has frequently expressed himself, he believes that they were in the nature of excessive growths which may have had their inception and impetus in some useful function, but grew beyond that use as the animal became more specialized. The union of the spines into a thin dorsal fin is far more probable and the idea is supported by the presence of rugosities and the channels of small nutrient vessels such as would lie beneath a thick dermal covering. The anterior and posterior faces of the bases of the spines have sharp, low ridges which give place to shallow grooves farther up the spine; only near the top are the spines similar on all sides. Moreover in the living genus *Basiliscus,* which has elevated dorsal spines, and in the genera of the chameleons in which the same thing occurs, for example, *Chameleo cristatus* Stutch., the spines are united into a thin dorsal crest by the integument and are further united by a thin membrane carrying scattered muscle fibers. The outline of the dorsal fin shown in the restoration is suggested by all the specimens in which the spines have been preserved. The sharp recurvature of the spines in the lumbar region is less pronounced in the specimen from which the restoration was drawn than in some other and it is possible that in other species there was even more of an overhang of the posterior end. The spines are abruptly shortened in the pelvic region and rapidly decrease on the tail. The length of the tail is not known but in all probability was elongate rather than short and stumpy.

The limbs were short and heavy with the forearm and foreleg shorter than the proximal segment of the limb, a condition which is quite common in slow moving forms or those of aquatic or palustrial habit, and just the reverse of the condition found in the active, raptorial *Dimetrodon.* The bones of the feet have not been found in position, but in the great Brier Creek Bone-bed in Archer County, Texas, excavated by an expedition from the University of Michigan in the summer of 1913, numerous large foot bones of a character different from those of *Dimetrodon* or the cotylosaur *Diadectes* were found associated with the spines of *Edaphosaurus* and with large claws. It is believed that the foot of that animal was of goodly size and armed with sharp claws well fitted for digging in the soft earth or vegetation, tearing open rotten logs and overturning rocks in search of food.

It has been noted by all collectors in the Texas beds that isolated vertebræ of *Edaphosaurus* are among the most common fossils found but that any portion of an associated skeleton is extremely rare. This has led to the suggestion that the remains of the animals were transported for some distance after death, probably by rivers from a higher land.

Edaphosaurus was a highly specialized creature, sluggish in movement and entirely harmless, living upon molluscs, insects and perhaps vegetation. It probably lived in the woods or near swamps at some distance from the lowlands upon which were deposited the deltas which make up the Wichita and Clear Fork formations.

In conclusion the author wishes to express his thanks to Dr. Ruthven, of the University of Michigan, for many valuable suggestions in arranging the pose and proportions of the restoration, and to Mr. Irwin Christman, of the American Museum, for the painstaking care with which his suggestions have been followed in making the drawing.[2]

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[2] A full account of the known specimens of *Edaphosaurus* and *Naosaurus* and a complete synonymy of the two genera will be found in Publications 55 and 181 of the Carnegie Institution of Washington.